

PATENT SPECIFICATION

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(54) IMPROVEMENTS IN AND RELATING TO
CHANNEL-SHAPED SEALING STRIPS

- (71) We, DRAFTEX DEVELOPMENT A.G., a joint stock company organised under the laws of Switzerland, of Schönbühl 3, 6300 Zug, Switzerland, do hereby declare this invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:-
- The invention relates to sealing strips, and more particularly to channel-shaped sealing strips such as have a longitudinal channel-shaped gripping portion for supporting the sealing strip in position on the frame of an opening which is closable such as by a window or a door, and a longitudinal sealing portion on and running alongside the gripping portion. An exemplary field of application of the invention is in vehicle body construction.
- According to the invention, there is provided a method of forming a corner in a length of sealing strip having a longitudinal gripping portion for gripping a support which supports the sealing strip in position and a longitudinal sealing portion on and running alongside the gripping portion, comprising the steps of bending the sealing strip to produce two lengths respectively aligned with the directions leading to the said corner, and moulding directly onto the sealing portion a corner section which is produced by a moulding operation at a temperature between ambient temperature and 60°C and has its exterior contour shaped to match the angle of the said corner.
- According to the invention, there is also provided a method of forming a corner in a length of sealing strip having a longitudinal channel-shaped gripping portion for gripping a support which supports the sealing strip in position and a longitudinal sealing portion on and running alongside the gripping portion, comprising the steps of bending the sealing strip to produce two lengths respectively aligned with the directions leading to the said corner, cutting away at least part of the sealing portion between the two said lengths of the sealing strip but leaving uncut the gripping portion, and moulding directly into the cut-out so formed in the sealing portion a corner section which is produced by a moulding operation at a temperature between ambient temperature and 60°C and has its exterior contour shaped to match the angle of the said corner.
- According to the invention, there is further provided a method of forming a corner in a length of sealing strip having a longitudinal channel-shaped gripping portion for gripping a support which supports the sealing strip in position and a longitudinal sealing portion on and running alongside the gripping portion, comprising the steps of attaching a flexible support member to the sealing portion at a predetermined region along its length, bending the sealing strip in the said region so as to produce two lengths leading away from that region and respectively aligned with the directions leading to the said corner whereby the said support member supports the material of the sealing section at the bend in the said region, and moulding directly onto the material of the sealing portion in the said region and on the outside of the said bend a corner section which is produced by a moulding operation at a temperature between ambient temperature and 60°C and is positioned on the outside of the said bend of the sealing portion and has its exterior contour shaped to match the angle of the said corner.
- According to the invention, there is still further provided a sealing strip for attachment into a corner of predetermined sharp angle, comprising a longitudinal gripping portion for gripping a support which supports the sealing strip in position and a longitudinal sealing portion on and running alongside the gripping portion, the sealing

strip being bent to follow the change in direction produced by the said corner but possibly parting from the angle at the corner, and including a corner section which is moulded directly onto the material of the

5 sealing at a temperature between ambient temperature and 60°C, the corner section having an exterior contour which matches the angle of the said corner.

10 According to the invention, there is yet further provided a sealing strip for attachment into a corner of predetermined sharp angle, comprising a longitudinal channel-shaped gripping portion for gripping a support which supports the sealing strip in position and a longitudinal sealing portion on and running alongside the gripping portion, the sealing strip being bent to follow the change in direction produced by the said

20 corner but possibly parting from the angle at the corner, and including a corner section which is moulded directly into a cut-out in the sealing portion at the corner at a temperature between ambient temperature and 60°C, the corner section having an exterior contour which matches the angle of the said corner.

25 According to the invention, there is still further provided a sealing strip for attachment into a corner of predetermined sharp angle, comprising a longitudinal channel-shaped gripping portion for gripping a support which supports the sealing strip in position, and a longitudinal sealing portion on and running alongside the gripping portion, the sealing strip being bent to follow the change in direction produced by the said

35 corner, a flexible support member attached to the sealing portion at the bend therein and supporting the material of the sealing portion at the bend, and a corner section which is moulded directly onto the material of the sealing portion at the outside of the bend at a temperature between ambient temperature and 60°C, the corner section having an exterior contour which matches the angle of the said corner.

40 Sealing strips embodying the invention, and methods according to the invention of making sealing strips, will now be described, by way of example only, with reference to the accompanying drawings in which:

45 Figure 1 is a perspective view of one form of the sealing strip, with its end shown in section;

50 Figure 2 shows one stage in a forming process for adapting the sealing strip of Figure 1 to fit a sharp corner;

55 Figure 3 shows a later stage in the forming process of Figure 2;

60 Figure 4 shows a perspective view looking in the direction of the arrow of Fig. 3;

65 Figure 5 shows the sealing strip of Figure 1 fitted onto a supporting flange at a corner thereof;

Figure 6 shows an exploded view corresponding to Figure 3 showing a slightly modified form of sealing strip;

Figure 7 is a plan view of a mould for use in carrying out the forming process of Figures 2 and 3;

Figure 8 is a section on the line VIII-VIII of Figure 7;

Figure 9 shows a perspective view of another form of the strip showing it at one stage in a forming process for adapting it to fit a sharp corner;

Figure 10 shows the sealing strip of Figure 9 after a later stage in the forming process; and

Figure 11 shows the sealing strip of Figure 9 fitted onto a door flange.

The sealing strips to be described in detail are for attachment around the frame of the door opening in a vehicle body. They are designed to clamp over the metal flange of the door opening and to carry a seal against which the vehicle door closes. Such a vehicle door opening may include a sharp corner where two frame portions meet at a point, or in a tight curve of small radius, and define a sharp angle between them which may be less than, greater than, or equal to, 90°. The sealing strips to be described provide a seal at such a corner.

As shown in Figure 1, the sealing strip comprises a gripping portion 2 and a sealing portion 4. The gripping portion 2 (which is shown in section at one end of the view of Figure 1) comprises an extrusion of plastics or like material 6 of generally channel-shaped form completely covering a metal carrier member 8, also of channel-shaped form. The metal carrier member 8 may comprise a series of U-shaped elements arranged side-by-side along the length of the gripping portion 2 and either connected by short flexible links or entirely disconnected. Other forms of carrier member used, however, it is designed so that the gripping portion 2 has reasonable flexibility. As shown in Figure 1, the inside facing walls of the material 6 are provided with longitudinally running gripping ribs 10.

The sealing portion 4 is made of elastomeric material 12 such as cellular rubber and is of hollow tubular form. It is attached to the gripping portion 2 by means of a strip-like member 14 which is secured (such as by adhesive) to the outside of one wall of the plastics material 6 and which is integral with a bridging section 16.

In use, the sealing strip to be described is fitted onto the door frame in a vehicle body by placing the gripping portion 2 onto a metal flange which surrounds the door opening, so that the open mouth of the channel of the gripping portion faces outwardly of the door opening and embraces the metal flange. The gripping portion 2 thus supports

the sealing portion 4 along the edge of the door opening, and in use the door closes on to the sealing portion 4 to provide an air and weathertight seal. The gripping ribs 10 in the sealing portion 2 help to resist inadvertent removal of the sealing strip.

The particular profile shown for the sealing portion 4 is advantageous in that the tubular part thereof is spaced from the gripping portion 2 by means of the bridging section 16. This enables the tubular part of the sealing portion 4 to hinge or pivot with respect to the gripping portion 2.

It will be appreciated that it is essential to provide a continuous seal around the corners of the door opening. If the corners are smoothly rounded with not too small a radius, then the gripping portion 2 can be bent to follow the curvature of the corner and no difficulty arises. If, however, the corner is sharp or curved on a small radius (and in practice the included angle at a corner in a door opening may be 90° or even less), then it may not be possible to bend the gripping portion 2 sufficiently sharply. Figures 2 to 5 show how the sealing strip being described is arranged to provide a proper seal around such a corner.

As shown in Figure 2, the gripping portion 2 is given a curve so as to align two lengths of the gripping portion with the lengths of the door frame on either side of the corner to be accommodated. However, no attempt is made to bend the gripping portion 2 sufficiently tightly to fit the actual corner.

In addition, a section is sliced out from the sealing portion 4 at the corner so as to produce a cut-out opening 18 therein which is bounded by two lips 20 and 22 which remain substantially parallel to the corresponding curves lines of the gripping portion 2 and two further lips 24 and 25 matching the cross-section of the sealing portion 4. The removal of the cut-out section of the sealing portion 4 prevents kinking or undue stretching occurring in the sealing portion 4 and the corner.

By means of an in-situ moulding operation to be described in more detail with reference to Figures 7 and 8, a separate corner section 26 (Fig. 3) is then moulded into place into the cut-out 18. As shown in Figure 3, the corner section 26 is formed so as to have an outer profile 28 which substantially exactly matches the angle of the change in direction at the corner to be accommodated. A comparison of Figures 3 and 4 shows that the corner section 26 completely closes off the cut-out 18 on the inside of the corner but leaves it open on the outside of the corner.

Figure 5 shows the sealing section of Figures 3 and 4 fitted onto the metal flange 30 of the door opening. It will be seen that the

flange 30 is gripped by the gripping portion 2, and that the corner section 26 matches the change in direction at the corner and also covers the gap (shown dotted at B) where the curved gripping portion 2 parts from the flange 30 at the apex of the corner. A neat external appearance is therefore preserved as well as a good seal around the door opening when the door is closed onto the sealing portion 4 and the corner section 26. The process of forming the corner section 26 is such that the joints 31 (Figs. 5 and 6) between it and the lips defining the cut-out portion 18 are substantially undetectable.

It will be appreciated that the gripping portion 2 may or may not part from the flange at the actual corner; this depends on the sharpness of the corner. However, whether or not the gripping portion does part from the flange, the corner section 26 ensures a good seal between the corner of the door and the door frame.

If desired, the exposed openings of the tubular sealing portion 4, at the corner under the corner section 26, may be closed off by suitable plugs.

The cut-out 18 (Fig. 2) may be modified by cutting more or less deeply into the sealing portion 4 than illustrated in that Figure. For example, the cut may be taken more deeply, and down as far as the surface of the gripping portion 2, so as completely to remove the sealing portion at the corner. It will be appreciated, however, that in every case the gripping portion 2 itself is not cut through. Therefore, although it may not grip the door flange at the actual corner, it is nevertheless present to provide firm support for the sealing portion 4 at the corner.

Other forms of corner section may be used instead of the corner section 26 shown.

Figure 6 shows one such alternative where the corner section 26 is formed with a configuration which substantially exactly matches the configuration of the sealing portion 4 and consists of two part-cylindrical surfaces which respectively match the external surfaces of the two lengths of the sealing portion 4 meeting at the corner, the two part-cylindrical surfaces of the corner section meeting along a line 32. In this form, as in the form shown in Figures 2 to 4, the corner section 26 will be moulded in-situ.

The moulding process will now be described more specifically with reference to Figures 7 and 8.

The mould comprises a base plate 40 carrying two guides 42 and 44. Each guide has two guide pins 46 projecting towards the other guide and these engage in slots in the side of a mould member 48. The mould member 48 is thus slidable to and fro in the direction of the arrows C. The mould member 48 is attached to a rod 50 which is

part of a piston-cylinder assembly 52 and is energisable to move the mould member 48 to and fro in the directions indicated.

5 The mould member 48 has a square profile at its end attached to the piston rod 50 while its opposite end has a specially shaped profile which is of the form of a rounded-V in plan view. As apparent from Figure 8, however, this end has projections 54 and 56
10 which define between them a trough 58 which extends around the curvature of the rounded-V in plan.

The profiled end of the mould member 48 rests on a support 59 which is attached to the base by studs 60 shown dotted in Figure 6.

20 The base 40 also supports two guide pins 62 for receiving mould members 64, 66 and 68. Mould member 64 has a projection 72 which is shaped to match the profile of the trough 58 in the mould member 48.

25 The mould member 66 is of thin plate-like form having a pointed edge 72 which is in the shape of a rounded-V in plan (see Fig. 7).

30 The mould member 68 is also plate-like in form but thicker than the member 66. It also presents a rounded-V edge 74 as viewed in plan, this edge being set back from the edge 72 of the mould member 66.

35 In operation, the mould member 48 is retracted by means of the piston-cylinder assembly 52. The plate member 66 (while it is separate from the remaining portions of the mould and not on the pins 62) is then offered up to the sealing strip which at this time is in the form shown in Figure 2 and held manually to the curve shown. The plate member 66 is inserted into the channel of the gripping section 2.

40 The plate member 66, with the bent sealing strip in position thereon, is then placed onto the guide pins 62, on top of the mould member 64, so that the sealing section 4 of the sealing strip is below the plate member 66 (that is, nearer to the base 40). The mould member 68 is then placed in position and held firmly by means of spring clips 76, 78. By means of the piston-cylinder assembly 52, the mould member 48 is then moved
50 towards the mould members 64, 66 and 68, until the end of its projection 54 abuts against the mould member 64. In this position, the mould members 48 and 64 define between them a mould cavity 80.

55 Suitable moulding material (to be described below) is then injected into a hole 82 which leads to the mould cavity 80 through a bore 84. The injected material is injected in such quantity as to fill the mould cavity 80 which, as will be apparent from Figure 7, is shaped to produce the desired configuration for the corner section 26 (see Figs. 3 and 4).

65 When the moulding operation is complete

and the corner section 26 has been formed and has cured, the mould member 48 is retracted by means of the piston-cylinder assembly 52, and the sealing strip, with the corner section 26 moulded in position, can then be removed.

70 According to the invention, the moulding operation is carried out either at ambient temperature (say 20°C) or not much above that temperature and not above 60°C. This is particularly advantageous as compared with other moulding operations taking place at enhanced temperature; such other enhanced temperature moulding operations would be unsatisfactory when used in an application such as the present application because they would necessarily involve the application of heat to material (the material of the gripping portion 2 and the sealing portion 4) which has inevitably already been subjected to heat during its own manufacturing process. Such dual application of heat is unsatisfactory because of its adverse effect on the properties of the twice-heated material, and can result in unacceptable alteration of the properties of the material and/or the production of an adverse appearance therefor.

95 One example of moulding material which can be used in the present case, in order to carry out the moulding operation at ambient or low temperature, is polyurethane which is injected into the mould in liquid or molten form mixed with between 1 and 3% of a catalyst in the form of polyisocyanate. Such an injected material cures quickly (between 4 and 8 minutes), for example depending on the temperature, and is compatible with the elastomeric material of the sealing section 4. An additional agent, to foam the polyurethane, may also be added.

100 In order to enhance the join between the moulded corner section 26 and the mating edges of the sealing section 4, the latter may be coated (before the moulding operation commences) with a neoprene glue or similar adhesive.

105 In order to enable the temperature of the moulding operation to be controlled, the mould member 48 is provided with an internal passageway 86, shown dotted in Figure 7, by means of which a heating or cooling medium may be passed through the mould member.

110 It will be appreciated that the mould shown in Figures 7 and 8 may be adapted when it is desired to mould corner sections of different configurations from the corner section 26 shown in Figures 3 and 4.

115 Figures 9, 10 and 11 show a modified construction. In manufacturing this form of strip, a length of strip of the form shown in Figure 1 is first produced. The next stage in the process comprises the insertion of a short length of a tubular sponge rubber
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insert into the hollow sealing portion 4 while it is in the form shown in Figure 1. The sponge rubber insert may be inserted in position by injecting suitable material through the side wall of the sealing portion 4 in that region where the corner is to be formed, possibly flattening the portion 4 on either side of the region to trap the injected material while it cures. Then, as shown in Figure 9, the gripping portion 2 is given a curve so as to align two lengths of the gripping portion with the length of the door frame on either side of the corner to be accommodated. No attempt is made to bend the gripping portion 2 sufficiently tightly to fit the actual corner. As shown in Figure 9 where the wall of the sealing portion 4 is shown broken away, the sponge rubber insert 88 is located at the corner, and supports the wall of the sealing portion 4 at the corner, preventing wrinkling of the material of the wall at the corner.

Then, by means of an in-situ moulding operation, a separate corner section 90 (Fig. 10) is moulded into place on the outside of the curved sealing portion 4. As shown in Figure 10, the corner section 90 is formed so as to have an outer profile 92 which substantially exactly matches the angle of the change in direction at the corner to be accommodated.

Figure 11 corresponds to Figure 4 and shows the sealing section of Figure 10 fitted onto the metal flange 30 of the door opening. It will be seen that the flange 30 is gripped by the gripping portion 2 and that the corner section 90 matches the change in direction of the corner and also covers the gap (as shown dotted at B) where the curved gripping portion 2 parts from the flange 30 at the apex of the corner. A neat external appearance is therefore preserved as well as a good seal around the door opening when the door is closed onto the sealing section 4 and the corner section 90.

The process of moulding the corner section 90 onto the sealing portion 4 is such that the join between it and the sealing portion is substantially undetectable.

The moulding process which is used to form the corner section 90 may be carried out using a mould of the same general form as shown in and described with reference to Figures 7 to 9 (but not having the projection 70).

As before, the moulding operation is carried out either at ambient temperature (say 20°C) or not much above that temperature and not above 60°C. Again, an example of moulding material which can be used in order to carry out the ambient or low temperature moulding operation is polyurethane which is injected into the mould in liquid or molten form mixed with between 1 and 3% of a catalyst in the form of a polyisocyanate.

Although the material of the sealing section 4 is advantageously foamed, the moulding material used to form the corner section 90 does not incorporate a foaming agent and the corner section is therefore formed in solid (unfoamed) material.

WHAT WE CLAIM IS:-

1. A method of forming a corner in a length of sealing strip having a longitudinal gripping portion for gripping a support which supports the sealing strip in position and a longitudinal sealing portion on and running alongside the gripping portion, comprising the steps of bending the sealing strip to produce two lengths respectively aligned with the directions leading to the said corner, and moulding directly onto the sealing portion a corner section which is produced by a moulding operation at a temperature between ambient temperature and 60°C and has its exterior contour shaped to match the angle of the said corner.

2. A method according to claim 1, including the step of cutting away at least part of the sealing portion between the two said lengths of the sealing strip but leaving uncut the gripping portion, and in which the said corner section is moulded directly into the said cut-out.

3. A method according to claim 1, in which the corner section is moulded onto the material of the sealing portion on the outside of a bend therein between the said two lengths.

4. A method of forming a corner in a length of sealing strip having a longitudinal channel-shaped gripping portion for gripping a support which supports the sealing strip in position and a longitudinal sealing portion on and running alongside the gripping portion, comprising the steps of bending the sealing strip to produce two lengths respectively aligned with the directions leading to the said corner, cutting away at least part of the sealing portion between the two said lengths of the sealing strip but leaving uncut the gripping portion, and moulding directly into the cut-out so formed in the sealing portion a corner section which is produced by a moulding operation at a temperature between ambient temperature and 60°C and has its exterior contour shaped to match the angle of the said corner.

5. A method of forming a corner in a length of sealing strip having a longitudinal channel-shaped gripping portion for gripping a support which supports the sealing strip in position and a longitudinal sealing portion on and running alongside the gripping portion, comprising the steps of attaching a flexible support member to the sealing portion at a predetermined region along its length, bending the sealing strip in the said region so as to produce two lengths leading away from that region and respectively

- aligned with the directions leading to the said corner whereby the said support member supports the material of the sealing section at the bend in the said region, and moulding directly onto the material of the sealing portion in the said region and on the outside of the said bend a corner section which is produced by a moulding operation at a temperature between ambient temperature and 60°C and is positioned on the outside of the said bend of the sealing portion and has its exterior contour shaped to match the angle of the said corner.
6. A method according to claim 5, in which the sealing portion is hollow or tubular and the support member is inserted into the sealing portion.
7. A method according to claim 3, 5 or 6, in which the corner section is moulded from material which produces a solid (unfoamed) structure.
8. A method according to claim 5 or 6, in which the support member comprises a length of sponge rubber.
10. A method according to any preceding claim, in which the corner section is moulded from polyurethane in combination with a catalyst or activator such as a polyisocyanate.
11. A sealing strip for attachment into a corner of predetermined sharp angle, comprising a longitudinal gripping portion for gripping a support which supports the sealing strip in position and a longitudinal sealing portion on and running alongside the gripping portion, the sealing strip being bent to follow the change in direction produced by the said corner but possibly parting from the angle at the corner, and including a corner section which is moulded directly onto the material of the sealing portion at the corner at a temperature between ambient temperature and 60°C, the corner section having an exterior contour which matches the angle of the said corner.
12. A strip according to claim 11, in which the said corner section is moulded directly into a cut-out in the sealing portion at the corner.
13. A sealing strip for attachment into a corner of predetermined sharp angle, comprising a longitudinal channel-shaped gripping portion for gripping a support which supports the sealing strip in position and a longitudinal sealing portion on and running alongside the gripping portion, the sealing strip being bent to follow the change in direction produced by the said corner but possibly parting from the angle at the corner, and including a corner section which is moulded directly into a cut-out in the sealing portion at the corner at a temperature between ambient temperature and 60°C, the corner section having an exterior contour which matches the angle of the said corner.
14. A strip according to claim 12 or 13, in which the sealing portion is of hollow tubular form, and the corner section has a corresponding external profile thereto.
15. A strip according to claim 12 or 13, in which the sealing portion is of hollow tubular form and the corner section has such shape in cross-section as to match the profile of the cut-out on the inside of the corner and to provide a projecting leaf having an outer edge matching the angle of the corner but leaving uncovered the profile of the cut-out on the outside of the corner.
16. A strip according to claim 11, in which the corner section is moulded directly onto the material of the sealing portion at the outside of the bend, the corner section having an outer profile which matches the angle of the said corner.
17. A strip according to claim 16, including a support member attached to the sealing portion at the bend therein and supporting the material of the sealing portion at the bend.
18. A sealing strip for attachment into a corner of predetermined sharp angle, comprising a longitudinal gripping portion for gripping a support which supports the sealing strip in position, and a longitudinal sealing portion on and running alongside the gripping portion, the sealing strip being bent to follow the change in direction produced by the said corner, a flexible support member attached to the sealing portion at the bend therein and supporting the material of the sealing portion at the bend, and a corner section which is moulded directly onto the material of the sealing portion at the outside of the bend at a temperature between ambient temperature and 60°C, the corner section having an exterior contour which matches the angle of the said corner.
19. A strip according to claim 17 or 18, in which the sealing portion is of hollow tubular form, and the support member comprises an insert of sponge rubber.
20. A strip according to any one of claims 16 to 19, in which the corner section is of solid (unfoamed) material.
21. A strip according to any one of claims 11 to 20, in which the gripping portion is channel-shaped with the sealing portion running on and along one outside side wall thereof.
22. A strip according to claim 21, in which the sealing portion includes a hollow tubular part which is attached to but spaced from the outside of the said one wall of the gripping portion by means of a flexible bridging member extending from the tubular part to a region on the said one wall near to the open side of the channel.
23. A method of forming a corner in a length of sealing strip having a longitudinal channel-shaped gripping portion for sup-

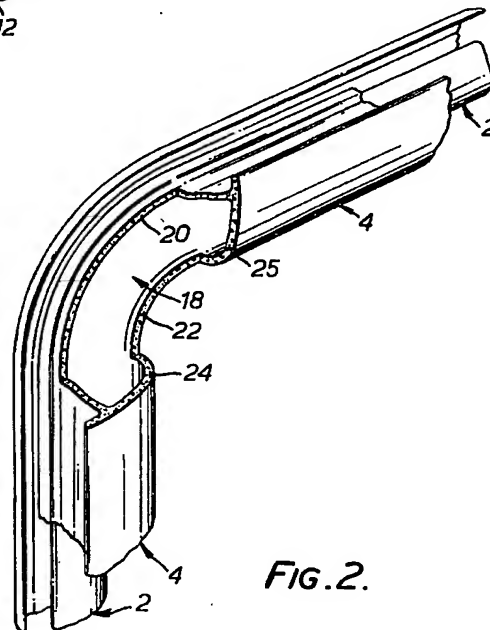
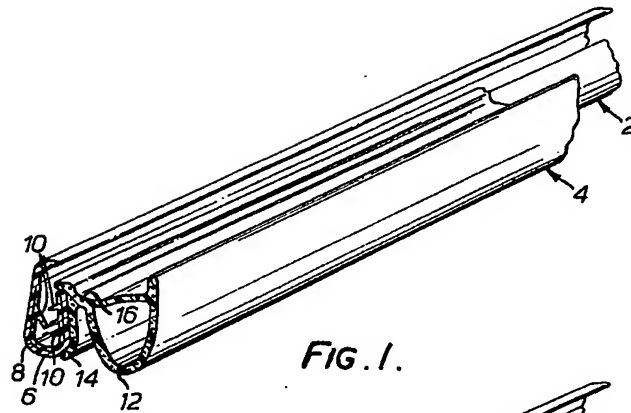
- 5 porting the sealing strip in position and a longitudinal sealing portion on and running alongside the gripping portion, substantially as described with reference to Figures 1 to 6 of the accompanying drawings.
- 10 24. A method of forming a corner in a length of sealing strip having a longitudinal channel-shaped gripping portion for supporting the sealing strip in position and a longitudinal sealing portion on and running alongside the gripping portion, substantially as described with reference to Figures 1 to 8 of the accompanying drawings.
- 15 25. A method of forming a corner in a length of sealing strip having a longitudinal channel-shaped gripping portion for supporting the sealing strip in position and a longitudinal sealing portion on and running alongside the gripping portion, substantially as described with reference to Figures 9, 10 and 11 of the accompanying drawings.
- 20 26. A sealing strip substantially as described with reference to Figures 1 to 6 of the accompanying drawings.
- 25 27. A sealing strip substantially as described with reference to Figures 9 to 11 of the accompanying drawings.
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Agents for the Applicants.

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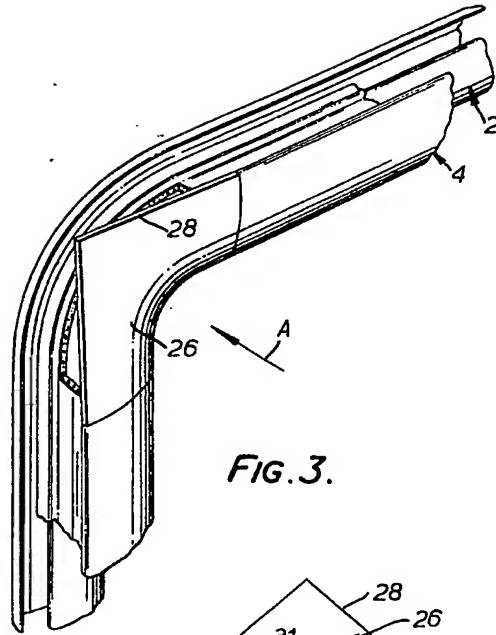


FIG. 3.

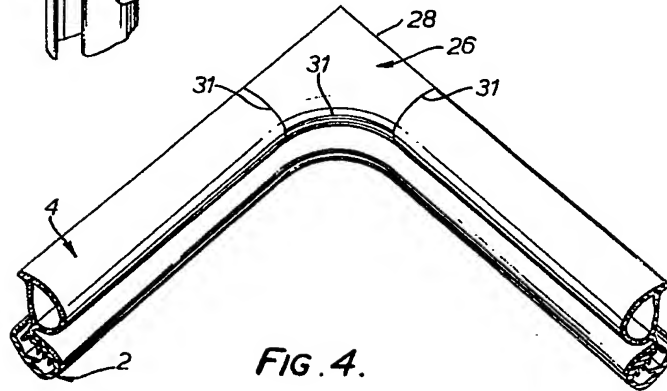


FIG. 4.

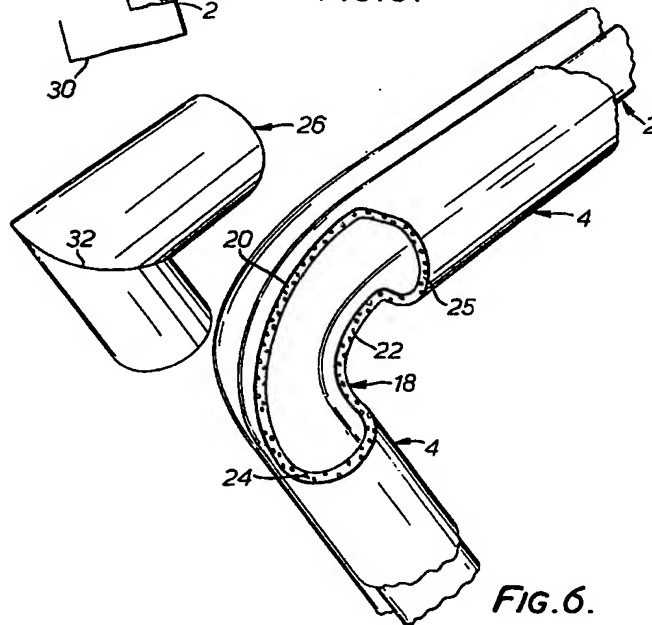
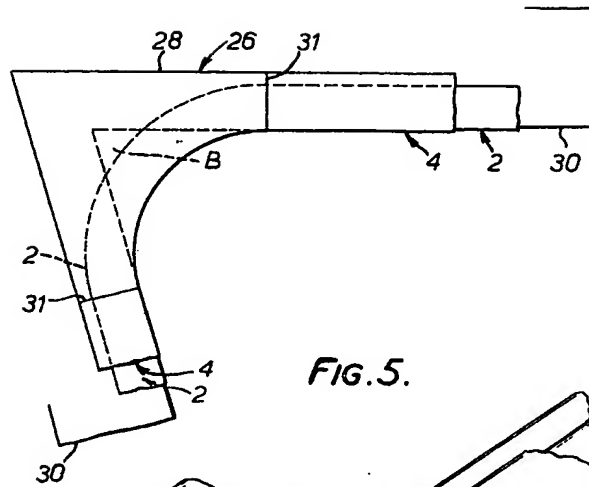
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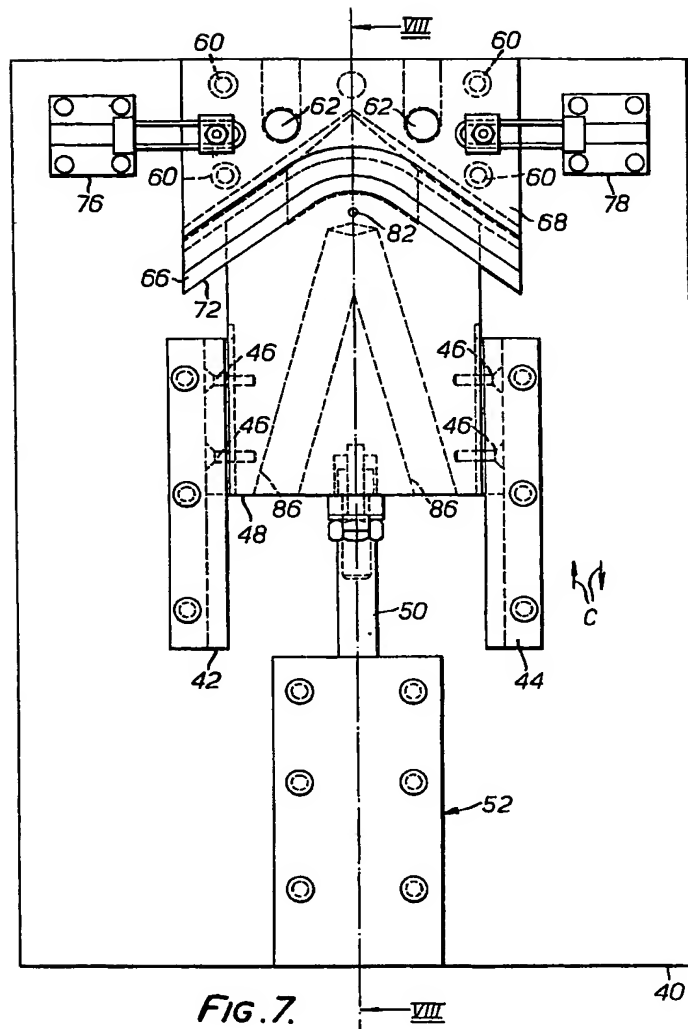
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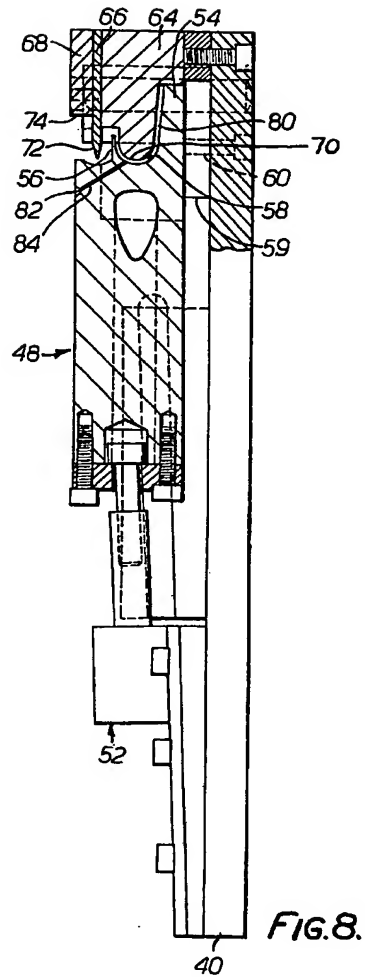
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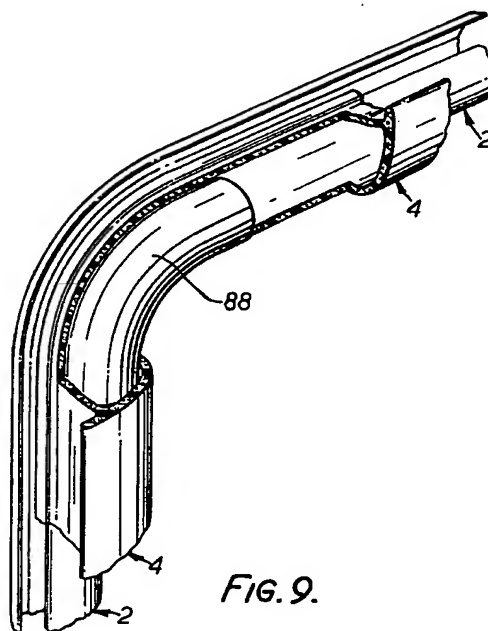


FIG. 9.

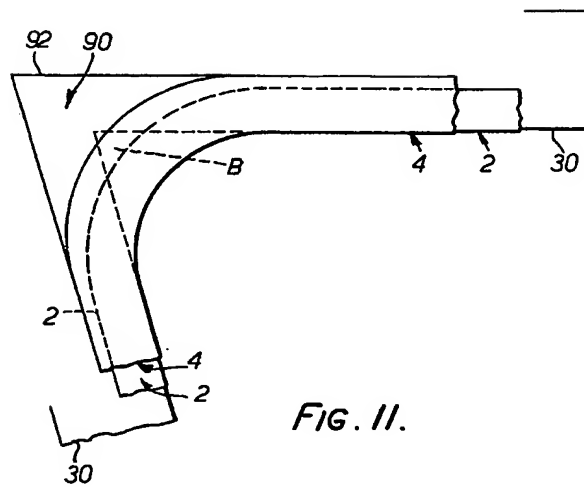
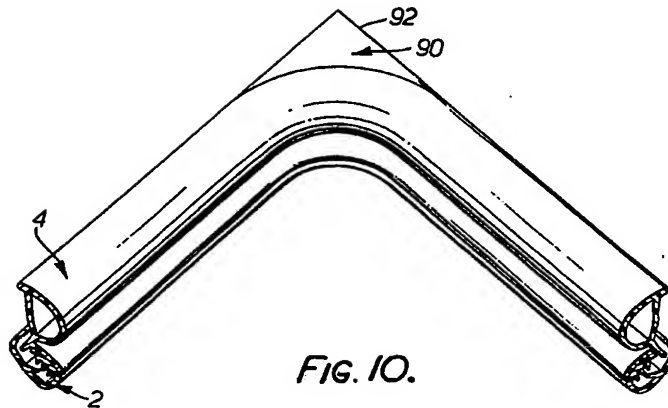
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